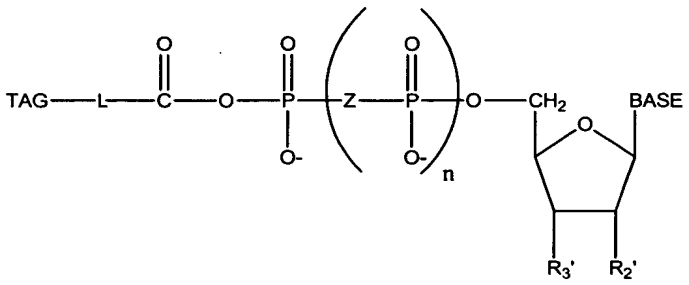
We claim:

1. An acyl-nucleotide probe having the formula:



wherein

BASE is a 5- or 6-membered unsaturated heterocyclic ring comprising from 1 to 3 ring nitrogens, wherein the 5- or 6-membered unsaturated heterocyclic ring is covalently attached through a ring nitrogen to the 1' position of the ribose or deoxy-ribose, wherein the 5- or 6-membered unsaturated heterocyclic ring optionally comprises a 6-membered unsaturated carbocyclic or heterocyclic ring fused thereto, said fused ring comprising from 1 to 2 ring nitrogens, and wherein each carbon position in the BASE may be optionally substituted by a substituent independently selected from the group consisting of -H, -F, -Br, -Cl, $-SCH_3$, -C(O)N(R)(R), -CN, $-NO_2$, -N(R)(R), =O, acetoxy, -C(R)(R)(R), $-OCH_3$, $-OCH_2CH_3$, methylene dioxy, trihalomethyl, trihalomethoxy, or $-(CH_2)_mOH$;

$R_{2'}$ and $R_{3'}$ are independently selected from the group consisting of -H, -OH, -F, -Br, -Cl, $-SCH_3$, -C(O)N(R)(R), -CN, $-NO_2$, -N(R)(R), acetoxy, -C(R)(R)(R), $-OCH_3$, $-OCH_2CH_3$, methylene dioxy, trihalomethyl, trihalomethoxy, $-(CH_2)_mOH$, or $-(CH_2)_m$-phenyl where phenyl is optionally substituted with -F, -Br, -Cl, $-SCH_3$, -C(O)N(R)(R), -CN, $-NO_2$, -N(R)(R), acetoxy, -C(R)(R)(R), $-OCH_3$, $-OCH_2CH_3$, methylene dioxy, trihalomethyl, trihalomethoxy, $-(CH_2)_mOH$;

n is 0-2;

m is 0 to 6;

TAG is a detectable label;

each Z is independently O, S, NH, or methylene;

L is an optionally present alkyl or heteroalkyl group of 1-40 backbone atoms selected from the group consisting of -N(R)-, -O-, -S- or -C(R)(R)-, wherein said alkyl or heteroalkyl group optionally includes a carbocyclic or heterocyclic group;

each R is independently H or -C_{1-6} alkyl straight or branched chain, or optionally form an optionally substituted fused carbocyclic or heterocyclic ring structure; and

the carbonyl adjacent to L is bound to a carbon to form an acyl group;

or a pharmaceutically acceptable salt or complex thereof.

2. An acyl-nucleotide probe according to claim 1, wherein BASE is a purine.

3. An acyl-nucleotide probe according to claim 1, wherein BASE is a pyrimidine.

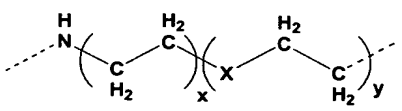
4. An acyl-nucleotide probe according to claim 1, wherein BASE is selected from the group consisting of adenine, thymine, uracil, guanine, cytosine, inosine, 5-bromouracil, 5-fluorouracil, 2-aminopurine, N^6-cyclohexyl adenine, 8-azaguanine, and 5-fluorocytosine.

5. An acyl-nucleotide probe according to claim 4, wherein BASE is selected from the group consisting of adenine, thymine, uracil, guanine, and cytosine.

6. An acyl-nucleotide probe according to claim 1, wherein $R_{2'}$ and $R_{3'}$ are independently H or OH.

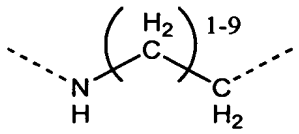
7. An acyl-nucleotide probe according to claim 1, wherein $R_{2'}$ and $R_{3'}$ are each OH.

8. An acyl-nucleotide probe according to claim 1, wherein L has the structure:

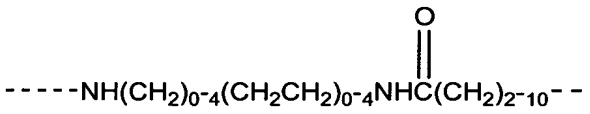


where x and y are independently in the range of 0 to 4, and X is O or CH_2.

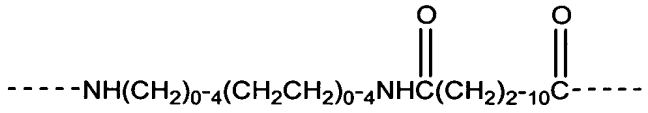
9. An acyl-nucleotide probe according to claim 1, wherein L has the structure:



;



; or

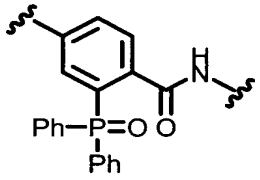


.

10. An acyl-nucleotide probe according to claim 8, wherein L has the structure - $NH(CH_2)_2(OCH_2CH_2)_{1-4}$-.

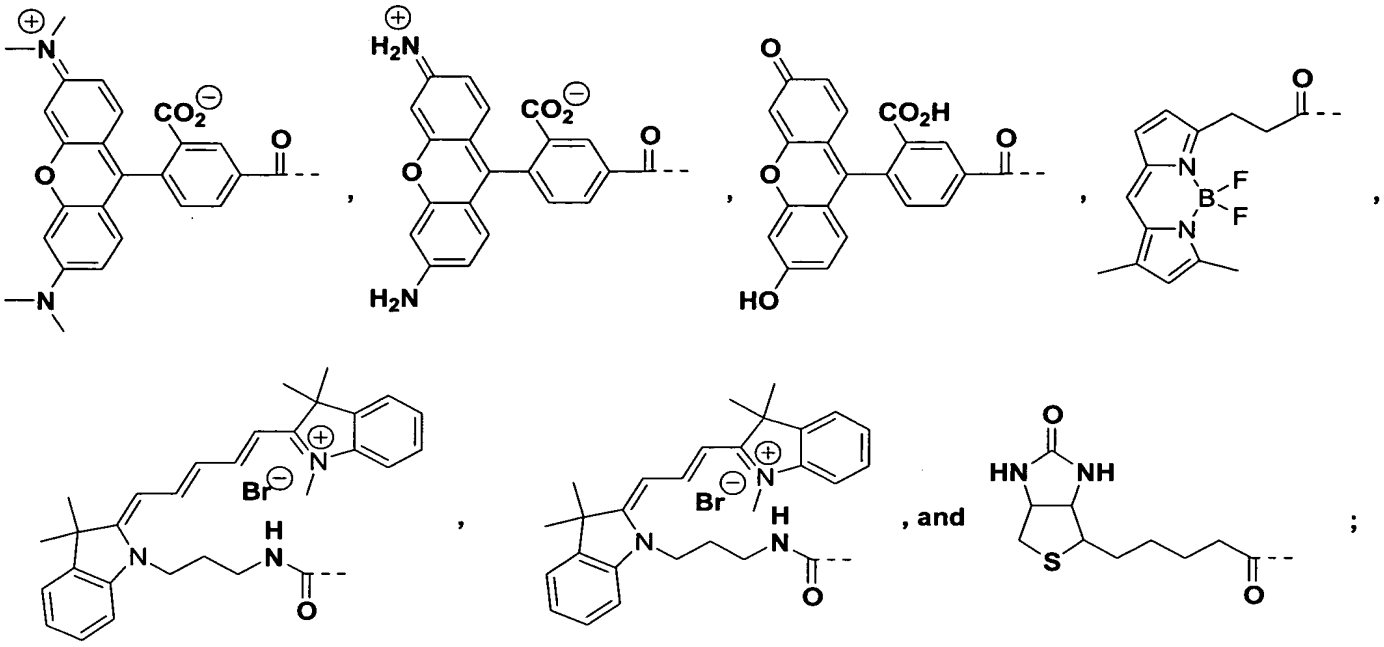
11. An acyl-nucleotide probe according to claim 1, wherein L comprises a triazole moiety.

12. An acyl nucleotide probe according to claim 1, wherein L comprises the following moiety:



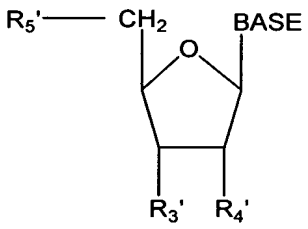
.

13. An acyl-nucleotide probe according to claim 1, wherein the TAG is selected from the group consisting of:



wherein 5-substituted carboxyrhodamine or 5-substituted carboxyfluorescein may be replaced with 6-carboxyrhodamine or 6-carboxyfluorescein, or with a mixture of 5- and 6-substituted carboxyrhodamine or carboxyfluorescein.

14. An acyl-nucleotide probe having the structure:

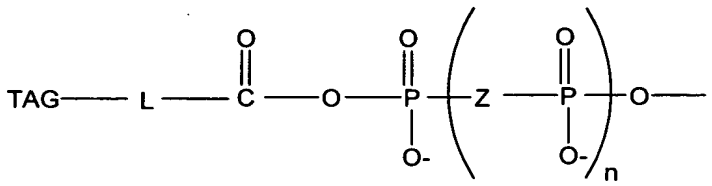


wherein

BASE is a 5- or 6-membered unsaturated heterocyclic ring comprising from 1 to 3 ring nitrogens, wherein the 5- or 6-membered unsaturated heterocyclic ring is covalently attached through a ring nitrogen to the 1' position of the ribose or deoxy-ribose, wherein the 5- or 6-membered unsaturated heterocyclic ring optionally comprises a 6-membered

unsaturated carbocyclic or heterocyclic ring fused thereto, said fused ring comprising from 1 to 2 ring nitrogens, and wherein each carbon position in the BASE may be optionally substituted by a substituent independently selected from the group consisting of -H, -F, -Br, -Cl, $-SCH_3$, -C(O)N(R)(R), -CN, $-NO_2$, -N(R)(R), =O, acetoxy, -C(R)(R)(R), $-OCH_3$, $-OCH_2CH_3$, methylene dioxy, trihalomethyl, trihalomethoxy, or $-(CH_2)_mOH$;

one of $R_{2'}$ and $R_{3'}$ and $R_{5'}$ has the following structure:



and the other two of $R_{2'}$ and $R_{3'}$ and $R_{5'}$ are independently selected from the group consisting of -H, -OH, -F, -Br, -Cl, $-SCH_3$, -C(O)N(R)(R), -CN, $-NO_2$, -N(R)(R), acetoxy, -C(R)(R)(R), $-OCH_3$, $-OCH_2CH_3$, methylene dioxy, trihalomethyl, trihalomethoxy, $-(CH_2)_mOH$, or $-(CH_2)_m$-phenyl where phenyl is optionally substituted with -F, -Br, -Cl, $-SCH_3$, -C(O)N(R)(R), -CN, $-NO_2$, -N(R)(R), acetoxy, -C(R)(R)(R), $-OCH_3$, $-OCH_2CH_3$, methylene dioxy, trihalomethyl, trihalomethoxy, $-(CH_2)_mOH$;

n is 0-2;

m is 0 to 6;

TAG is a detectable label;

each Z is independently O, S, NH, or methylene;

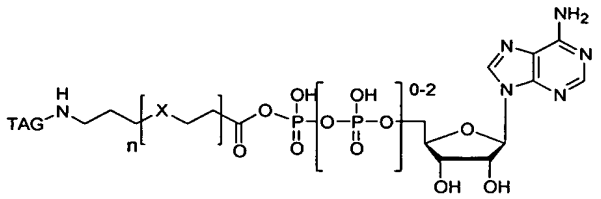
L is an optionally present alkyl or heteroalkyl group of 1-40 backbone atoms selected from the group consisting of -N(R)-, -O-, -S- or -C(R)(R)-, wherein said alkyl or heteroalkyl group optionally includes a carbocyclic or heterocyclic group;

each R is independently H or $-C_{1-6}$ alkyl straight or branched chain, or optionally form an optionally substituted fused carbocyclic or heterocyclic ring structure; and

the carbonyl adjacent to L is bound to a carbon to form an acyl group;

or a pharmaceutically acceptable salt or complex thereof.

15. An acyl-nucleotide probe having the structure:



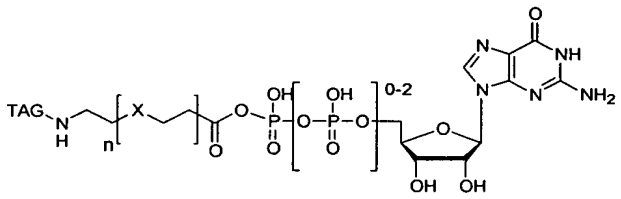
wherein

n is 1-4; and

TAG is a detectable label;

or a pharmaceutically acceptable salt or complex thereof.

16. An acyl-nucleotide probe having the structure:



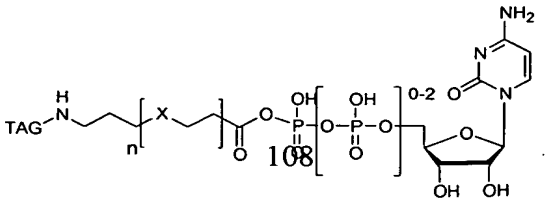
wherein

n is 1-4; and

TAG is a detectable label;

or a pharmaceutically acceptable salt or complex thereof.

17. An acyl-nucleotide probe having the structure:



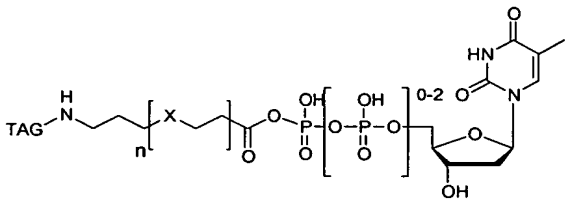
wherein

n is 1-4; and

TAG is a detectable label;

or a pharmaceutically acceptable salt or complex thereof.

18. An acyl-nucleotide probe having the structure:



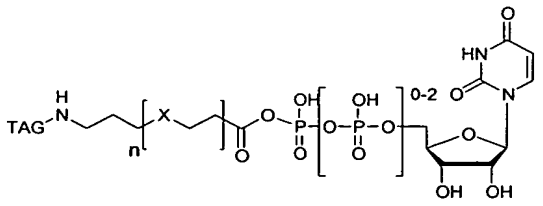
wherein

n is 1-4; and

TAG is a detectable label;

or a pharmaceutically acceptable salt or complex thereof.

19. An acyl-nucleotide probe having the structure:



wherein

n is 1-4; and

TAG is a detectable label;

or a pharmaceutically acceptable salt or complex thereof.

20. A method for determining the enzyme profile of one or more target proteins in a complex protein mixture, employing one or more probes comprising a nucleotide covalently bound through the terminal phosphate of a 5' mono- di- or tri-phosphate to an acyl group, which is further covalently bound to a TAG via a linker moiety "L", wherein said acyl group forms an adduct with said target protein(s) when said probe is bound to said target protein(s), said method comprising:

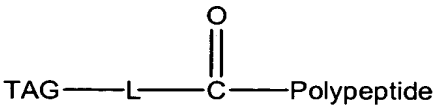
combining in a reaction medium said probe(s) and said complex protein mixture under conditions of reaction of said probe(s) with said nucleotide binding protein(s), whereby a conjugate of said probe(s) and said target protein(s) is formed; and

determining said enzyme profile by generating a signal from one or more conjugates formed thereby;

wherein said probe(s) are selected from the nucleotide binding protein-directed probes of one of claims 1-18.

21. A method according to Claim 20, wherein said probe binds to a plurality of target proteins.

22. A composition comprising a purified labeled polypeptide having the structure:



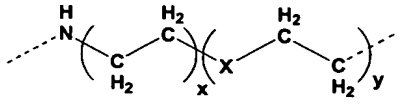
wherein TAG is a detectable label or a solid support;

L is an optionally present alkyl or heteroalkyl group of 1-40 backbone atoms selected from the group consisting of -N(R)-, -O-, -S- or -C(R)(R)-, wherein said alkyl or heteroalkyl optionally includes a carbocyclic or heterocyclic group;

the carbonyl adjacent to L is bound to a carbon to form an acyl group; and

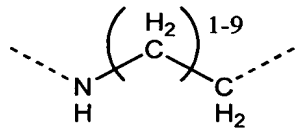
the acyl group is covalently attached through an amide, ester, or thioester linkage to a Polypeptide amino acid residue.

23. A composition according to claim 22, wherein L has the structure:

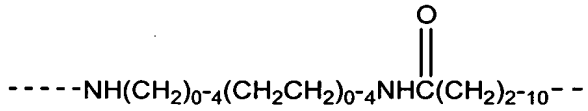


where x and y are independently in the range of 0 to 4, and X is O or CH_2.

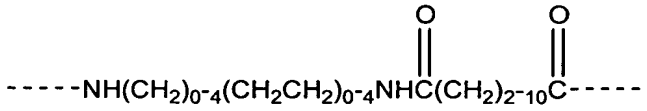
24. A composition according to claim 22, wherein L has the structure:



;



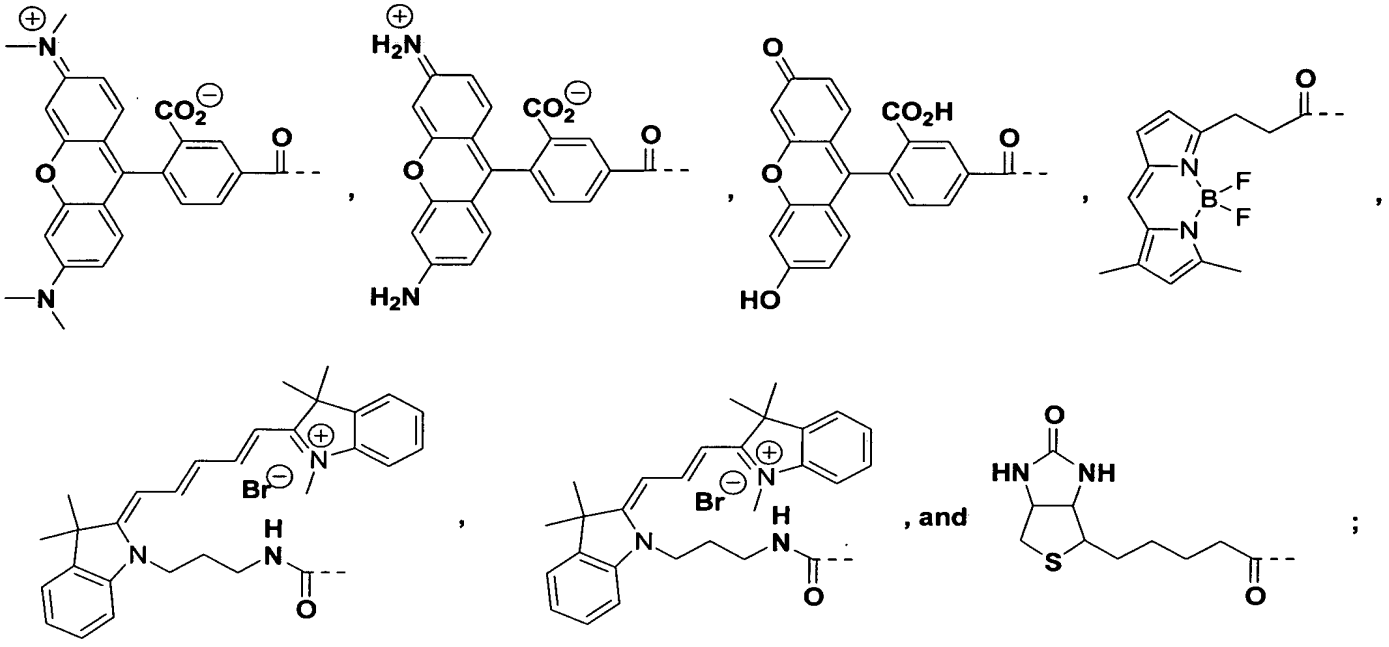
; or



.

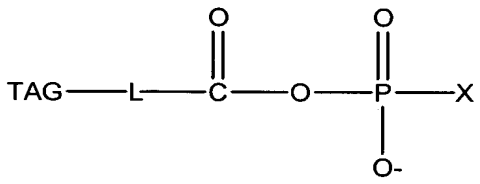
25. A composition according to claim 20, wherein L has the structure - $NH(CH_2)_2(OCH_2CH_2)_{1-4}$-.

26. A composition according to claim 20, wherein the TAG is selected form the group consisting of:



wherein 5-substituted carboxyrhodamine or 5-substituted carboxyfluorescein may be replaced with 6-carboxyrhodamine or 6-carboxyfluorescein, or with a mixture of 5- and 6-substituted carboxyrhodamine or carboxyfluorescein.

27. A tagged acyl phosphate or phosphonate probe having the formula:



wherein

X is an affinity moiety for directing the binding of said TAPP to one or more target proteins linked to the phophate through an oxygen or carbon;

TAG is a detectable label;

L is an optionally present alkyl or heteroalkyl group of 1-40 backbone atoms selected from the group consisting of -N(R)-, -O-, -S- or -C(R)(R)-, wherein said alkyl or heteroalkyl group optionally includes a carbocyclic or heterocyclic group;

each R is independently H or -C_{1-6} alkyl straight or branched chain, or optionally form an optionally substituted fused carbocyclic or heterocyclic ring structure; and

the carbonyl adjacent to L is bound to a carbon to form an acyl group;

or a pharmaceutically acceptable salt or complex thereof.

28. The tagged acyl phosphate probe of claim 27, wherein X is selected from the group consisting of a nucleotide, nucleotide analogue, optionally substituted naphthyl group, small molecule, steroid, peptide hormone, enzyme cofactor, vitamin, enzyme substrate, lipid, prostaglandin, or receptor ligand.

29. A method of synthesizing a tagged acyl phosphate or phosphonate probe, comprising:

contacting a detectable label comprising a linking group L terminating in a carboxyl group, with a nucleotide or nucleotide analogue comprising a 5'-linked phosphate comprising an available -OH group in the presence of diisopropylcarbodiimide or isobutyl chloroformate and triethylamine to form said tagged acyl phosphate or phosphonate probe; and

purifying said probe.